Improving Modeling and Simulation Decision Support Tools

for the Warfighter

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Goal: C2 Decision Support Tools

Supporting the Warfigh

Overview

Goal: Meet Warfighters' C2 Decision Support Needs

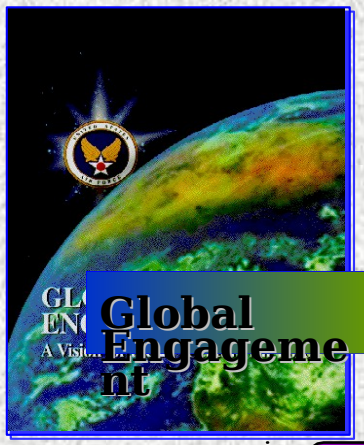
- **Guiding Strategies and Visions**
- **Command and Control (C2)**
- **C2 Decision Support**
- **Roadmap to Satisfy Needs**

Strategy and Vision

Shape	Respond			Reshape
	Deter	Halt	Win	
Prepare Now				

Global Engagement Operations

- Delivers aerospace power across full spectrum of military operations
- Enhances U.S. ability to redress crises quickly
- Reduces risks to forces and non-combatants
- Provides more options to commander and NCA to achieve Full Spectrum Dominance



USAF Core Competencies

Air and Space Superiority

Information Superiority
Global Attack
Precision Engagement
Rapid Global Mobili
Agile Combat Sur

Expeditionary Aerospace

Full Spectrum Dominance

National Military Strategy

- Shape-the international environment
- Respond-to the full spectrum of crises
- Prepare Now-for an uncertain future

National Security Strategy

Air Ops Center: Do It Faster, Better,

Strategy and Vision

Evolving to an EAF

- Commanders' NOTAM 98-4 on EAF:
  - "…emphasizes ***more rapid and effective operations****, with forces trained to task."
  - "…***geographically separated, but operationally-linked units**** to provide support to ongoing operations and ***rapid response to crises****."
  - "By January 2000…Successful implementation … will require innovative ideas…"

  ****areas in need of decision support improvements***

"Part of the expeditionary mode is the ability to command and control whatever forces you have forward. Part of that is to get the show on the road quickly." — General Ryan

Command and Control is Leadership

Command and Control

Crisis Action Planning (CAP) Phases

Situation Development: Evaluate possible scenarios

- **Update C2 and simulation database; look at options**

Crisis Development: Force structure and beddown scenarios

- **Planned at right level and in the right locations?**

COA Development: Recommend forces, locations, course to JFC

- **COA analysis through air art and computation**

COA Selection: JFACC develops Joint Air Ops Plan

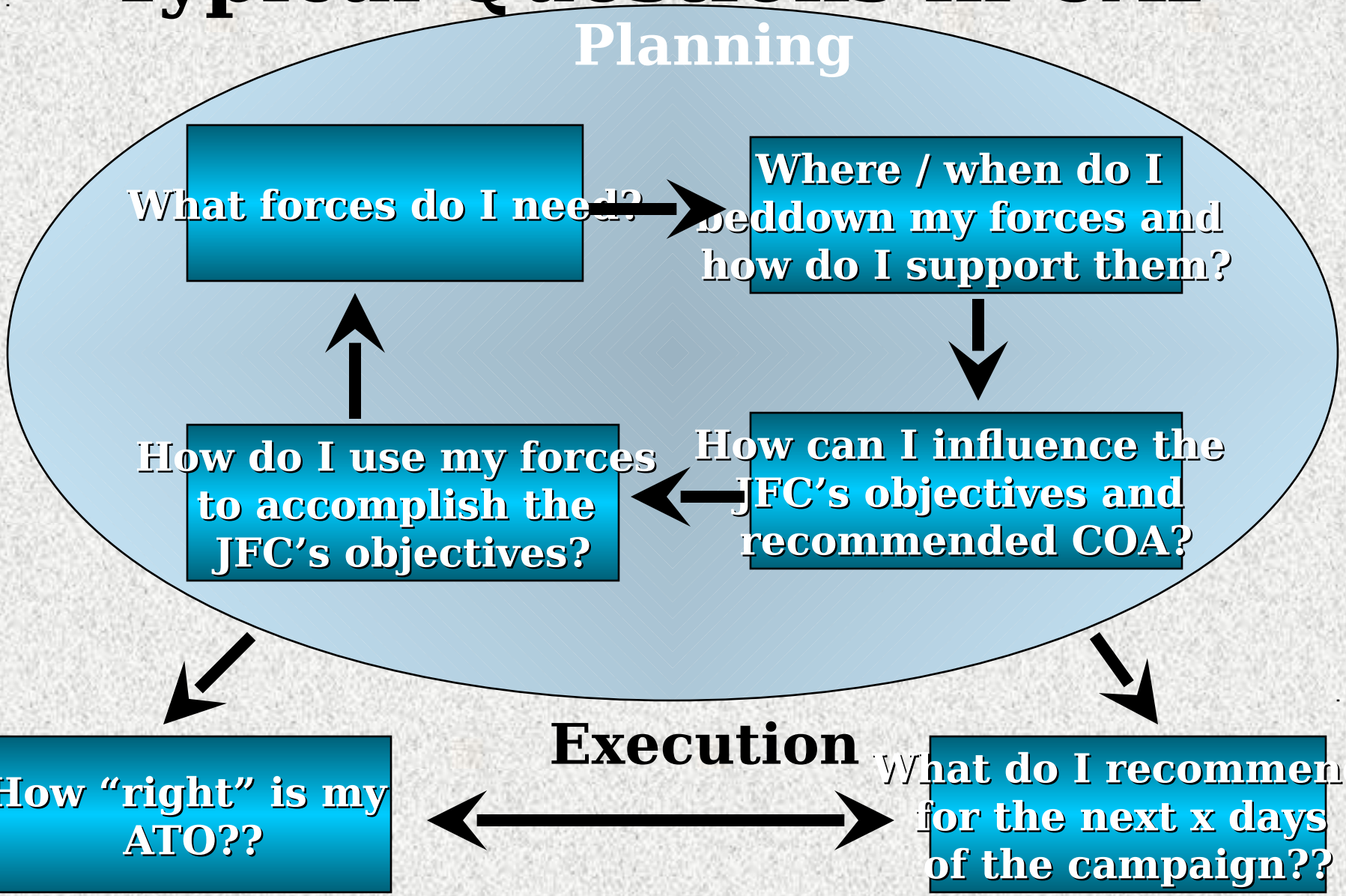
- **Air strategy and Centers of Gravity analyzed in terms of history and operational environment research**

Execution Planning: JFACC develops ATO 1, 2, 3…

- **Achieve JFC's goals by orchestrating desired**

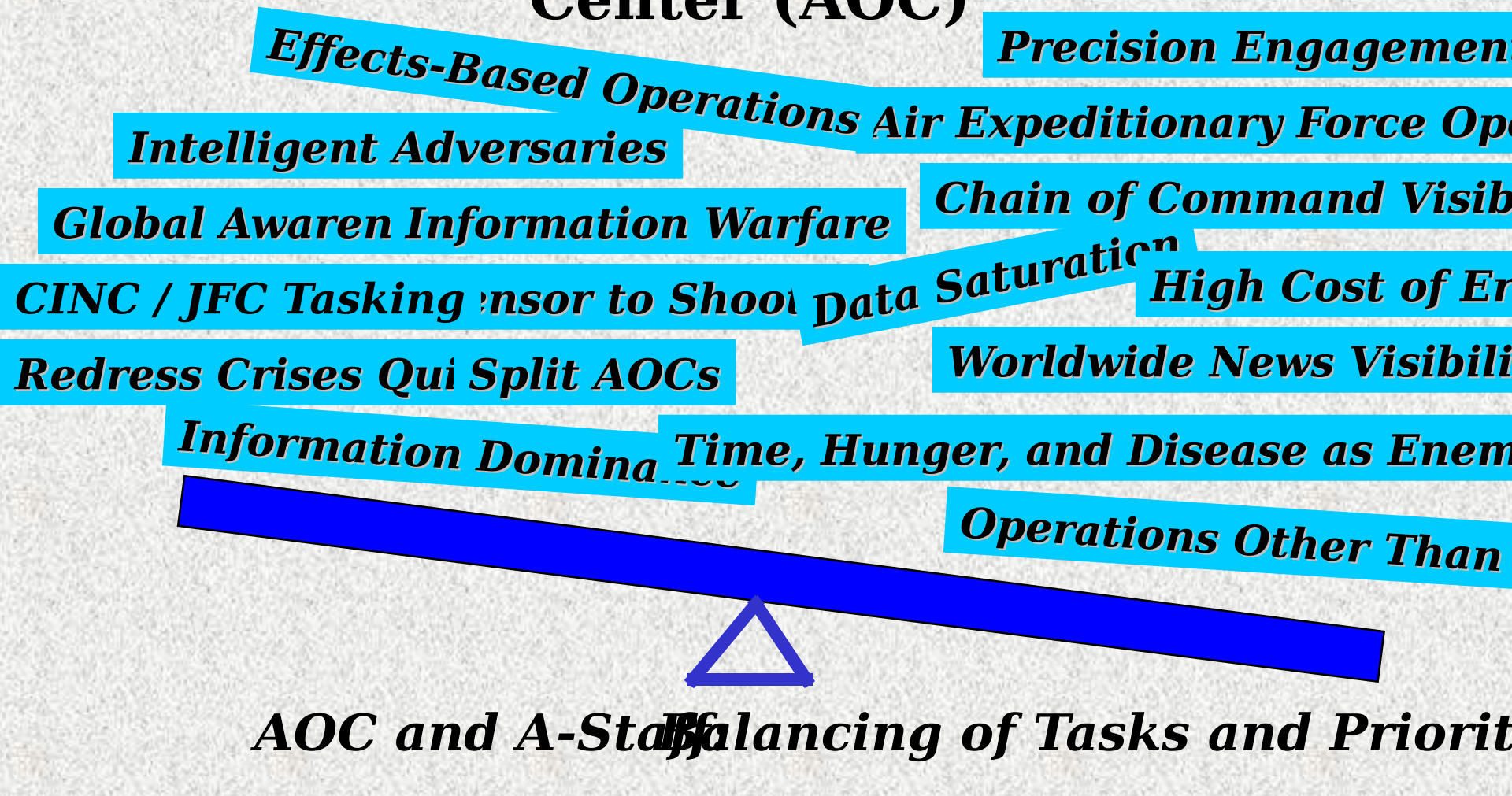
Command and Control

Typical Questions in CAP


Planning
What forces do I need?
Where / when do I beddown my forces and how do I support them?
How can I influence the JFC's objectives and recommended COA?
How do I use my forces to accomplish the JFC's objectives?
Execution
How "right" is my ATO??
What do I recommend for the next x days of the campaign??

Command and Control

Pressures on the Air Operations Center (AOC)



AOC and A-Staff Balancing of Tasks and Priorit

Solution: Provide tools to the JFACC / AFFOR for dec
all phases of crisis action planning, including execut

Absent C2 …. total combat performance is at ris

“All of this talk about super-weapons and push-button warfare is a pile of junk. Man is the only war machine. Man has to drive tanks, fly the planes, crawl through the mud, pull the triggers, and push the buttons. We must train to be strong in body and mind. Always remember man is the only war machine.”

General George S.

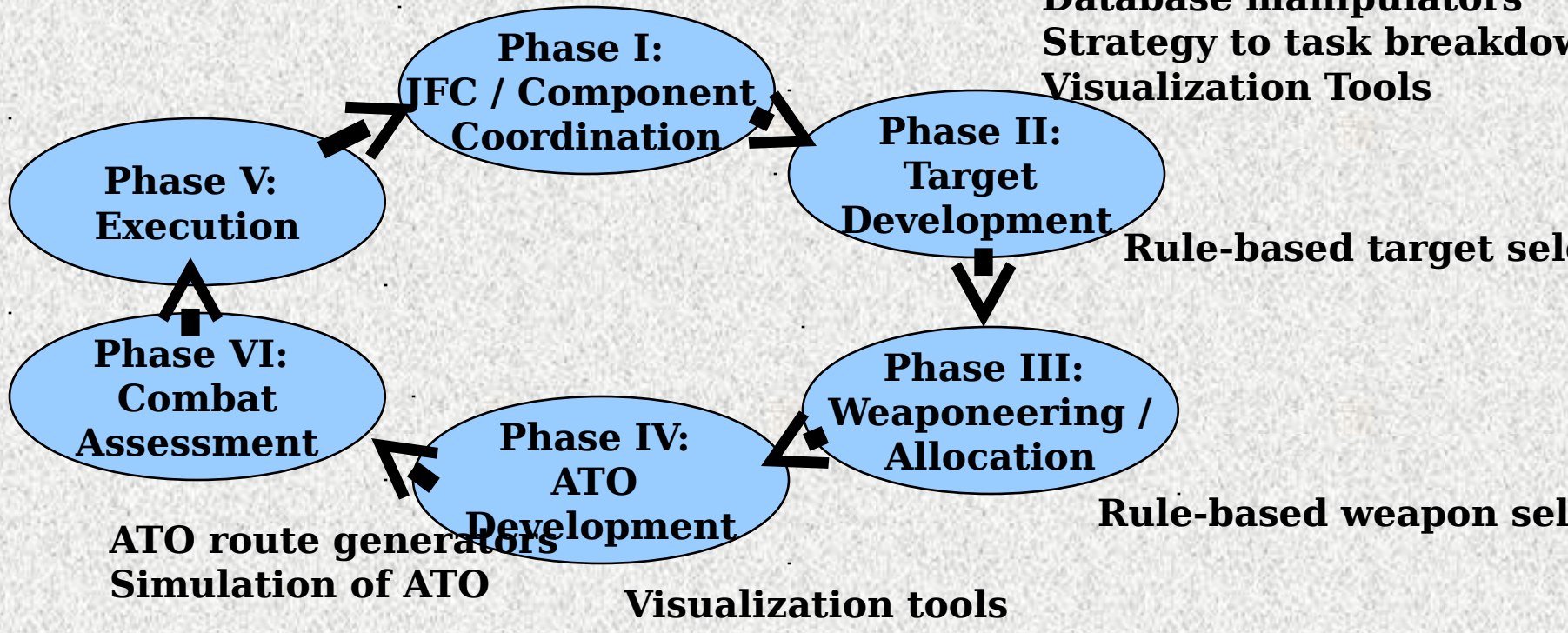
C2 Decision Support

Decision Support Tools

- Efficient population and update of databases
  - Data sharing across C2, ISR, M&S
- Automated tools for logistics decision making
  - Beddown bases for forces; aerial ports of deba
  - Closure of forces and supplies; force support,
- Course of Action Analysis
  - For pure OOTW, logistics alternatives
  - For warfighting, force structure and employme
  - Prediction of enemy actions
- ATO options and quality control
  - Test-fly ATO options; what-if analysis of variat
  - Test-fly the ATO prior to release or prior to exe
    - Check orbits, timing, threat suppression, ta
- Visualization of analyses

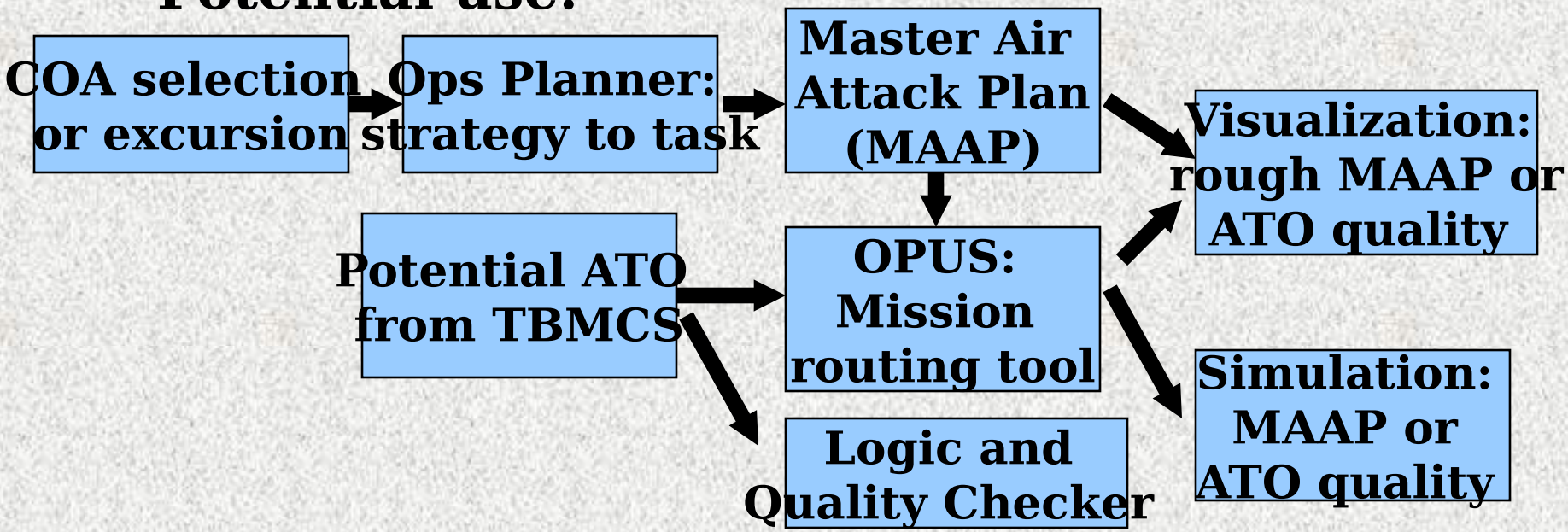
C2 Decision Support

- ATO fly-out and rehearsal candidates
  - AMASS (ESC/DIS, EADSIM, C2TIC)
  - AWSIM + JQUAD (WPC, CINC Initiative)
  - Naval Simulation System (NSS) in Tandem T
  - TBMCS improvements (ESC/DI)
- JFACC Planning Cycle:



C2 Decision Support

- Crisis Action Planning tools
  - EADSIM (Checkmate)
  - Operations Planner (Checkmate)
  - JWARS may prove useful (AFSAA, PA&E, J8)
  - Air Courses of Action Model (J8, PACOM)
  - Logistics models for OOTW
  - Consider reachback or deployment for analys
- Potential use:


COA selection or excursion
Ops Planner: strategy to task
Master Air Attack Plan (MAAP)
Visualization: rough MAAP or ATO quality
Potential ATO from TBMCS
OPUS: Mission routing tool
Simulation: MAAP or ATO quality
Logic and Quality Checker

Roadmap

- Verify decision support tool requirements
  - Coordinate with C2TIC, C2 Battle Lab (C2B), and WPC (Jan-Feb 1999)
  - Coordinate with AFSAA and analysis community (Jan 1999)
- Brief Air Force Command and Control M&S Symposium (Apr 1999)
  - NAF representatives invited

Roadmap

- Verify/compile decision support requirements
- Survey plans for new fielded tools
  - Consult with C2TIC, C2B, WPC, AFSAA, ESC/DIS
- Propose EFX initiative for decision support and evaluation of reachback analysis support
  - Look for promising off-the-shelf, fielded tools
  - Highlight successful data management techniques and visualization systems critical to rehearsal
  - Look at forward support concept or reachback
- Brief AFMSAWG in late FY 99 on progress, findings, and proposed FY00 planning

Summary

- Guiding Strategies and Visions
- Command and Control (C2)
- C2 Decision Support
- Roadmap to Satisfy Needs

Provide AEF, NAF, AFFOR, and Joint Force Air
Component Commanders access to the right
cision Support tools and analysis at the right t

“Airpower is like poker. A second-best hand is like none at all -- it will cost you dough and win you nothing.”

General George Kenney, USA

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Questions??

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Back-Up Slides

Operational Requirements

Nimble Lion (1998) verified:

- **No central database exists for storing mission re data for later analysis**
- **Visualization tools are not robust**
- **No robust ATO analysis tools available**

Nimble Lion was a first step to using traini models for ATO analysis purposes

- **Too early to tell if this is a good or bad idea**
- **Goal: simulate ATO mission execution, assess results and feedback into ATO refinement, and briefing of results and rudimentary analysis**

C2 Decision Support

- **Focus on areas for improvement**
  - **ATO fly-out and rehearsal candidates**
    - **AMASS (ESC/DIS, EADSIM, C2TIC)**
    - **AWSIM + JQUAD (WPC, CINC Initiative)**
    - **Naval Simulation System (NSS) in Tandem Thrust 99**
    - **TBMCS improvements (ESC/DI)**
  - **Crisis Action Planning tools**
    - **JWARS may prove useful (AFSAA, PA&E, J8)**
    - **Air Courses of Action Model (J8, PACOM)**
    - **Logistics models for OOTW**
    - **Consider reachback or deployment for analysis support**
  - **Database sharing (look at DII/COE tools)**
  - **Visualization systems**

Survey of Available Tools

- **More extensive lists of Decision Support Tools are available**

Analysis Shop and JS J-7

- **Tools to consider:**
  - ***ATO Modeling and Simulation System (AMASS)**** **- from E**

    in Blue Flags, EFX 98, and EFX 99. AMASS has grown from

    agent software to include visualization checker. May inclu

    simulation using additional parts of EADSIM.
  - ***Automated Air Tasking Analysis Capability (AATAC)**** **- be**

    developed by System Simulation Support Inc (S3I) as a SB

    "Time Critical C2" #AF99-117. Compatible with THUNDE

    STORM (THUNDER follow-on), and TBMCS. Designed to g

    analyze, modify, and regenerate ATOs
  - ***Naval Simulation System (NSS) JFACC Planning Tool**** **- B**

    by SPAWAR to read JTL, automatically draft JIPTL, weapon

    generate MAAP through optimization relative to threats, re

    fly MAAP for insight into outcomes / predicted BDA and los
  - **Commander's Planning and Execution Tool (CPET) - Joint**

    C2 Battle Lab and SPAWAR (may be NSS tool described abo

Survey of Available Tools

- **Combined Targeting Board - Automation Module - Develope**
7th Air Force
- **Joint Targeting Toolbox - TBMCS**
- ***Operations Planner**** **- Developed by Simulation Support Inc**
Automates strategy to task development from CINC objective
route optimization using OPUS, and visualization/analysis via
- **WPC - CINC Initiative to develop and implement an ATO an**
and flyout capability
- **Total Airspace Model (TAM) - Developed by CACI to model a**
from push back at the gate or at chocks to in the gate or cho
destination airport
- **ATO/ACO Tool**
- **ADEPT/TSM**
- **ATO X**
- **ELVIS**

*** Promising new developments for ATO Decision Supp**

Survey of Available Tools

Defining the mission - specified tasks

• CATS (Consequences Assessment Tool Set) - Natural and t
disaster including war (Defense Special Weapons Agency)
• DEXES (Deployable Exercise System) - Impact of military
on civilian populations (SOUTHCOM)
• EADSIM (Enhanced Air Defense System) - Analytic model
to campaign air defense scenarios (Army Space, ballistic m
defense organizations)
• FAST-OR (Force Analysis Spreadsheet Tool-OOTW) - Non-c
support requirements (Army Concepts Analysis Agency)
• HEAT (Headquarters Effectiveness Assessment Tool) - Spr
used to assess effectiveness of command and control headq
Interoperability Test Command)
• ITEM (Integrated Theater Engagement Model) - Theater-l
for air and naval planning and analysis (Defense Special We

[1] **"M&S Tools for the JTF Command and Staff: Enhancing Mission Analysis and Training", Warn**
Interservice / Industry Training, Simulation and Education Conference, December 1998

Survey of Available Tools

Defining the mission- specified tasks (contin

• SPECTRUM - Combines conflict with multi-variate sociologi
including political, economic, and socio-cultural (National Si
• TERRA (Training for Enemy Rapid Response Allocations) -C
emergency planning (STRICOM)

Defining the mission- implied tasks (contin

• FDE (Force Deployment Estimator) - Provides first-cut estim
of desired deployment of ground, air and sea forces and their
• Janus - Interactive, multi-sided, near-real-time, force-on-for
resolution model (National Simulation Center)
• JICM (Joint Integrated Contingency Model) - Interactive the
composed of an integrated family of simulations for ground w
• JFAST (Joint Flow and Analysis System for Transportation) -
strategic air and sea lift (TRANSCOM)

Survey of Available Tools

Defining the mission- implied tasks (contin

• LPX-MED (External Logistics Processor) - Theater-level lo
analysis tool for medical assets networks and evacuation as
conventional warfare or NBC environments
• MIDAS (Model for Intertheater Deployment by Air and Sea
deployment analysis model for movement of combat and sup
sustainment, including all aspects of air and sea lift and pre
• SIAM (Situational Influence Assessment Module) - Influen
to analyze OOTW (USACOM, SAIC)

Determining forces and employment

• ACPT (Air Combat Planning Tool) - Planning system for CO
of gravity, campaign and air component objectives (HQ USA
• AMP (Analysis of Mobility Platforms) - Mobilization suppo
generates a TPFDD

Survey of Available Tools

Determining forces and employment (conti

• ALPS (Area Limitation Planning System) - Sensor planning fixed and UAV platforms (MITRE)

• CATS (Consequences Assessment Tool Set) - Natural and te disaster including war (Defense Special Weapons Agency)

• ELIST (Enhanced Intra-Theater Logistics Support Tool) - An transportation planning (CENTCOM, TRANSCOM)

• FAST-OR (Force Analysis Spreadsheet Tool-OOTW) - Non-co support requirements (Army Concepts Analysis Agency)

• JFAST (Joint Flow and Analysis System for Transportation) for strategic air and sea lift (TRANSCOM)

• KBLPS (Knowledge Based Logistics Planning Shell) - Calcu requirements and allocation and transportation of supplies (UNC & CFC Korea)

• LOGSIM (Logistics Simulator) - Logistics model in the AF S for the Joint Training Confederation (USAFE, EUCOM)

Survey of Available Tools

Determining forces and employment (conti

• OLOGPIN (Operations Logistics Planner) - Estimates mater
classes of supply (except VII and XI) for Army units down to
company level (UNC & CFC Korea)
• RESA (Research, Evaluation and Systems Analysis) - Model
warfare used predominantly for training (Naval Research and
• SUMMITS (Scenario Unrestricted Mobility Model for Intra-
Simulation) - Model for all phases of inter-theater mobility fr
departure to tactical assembly area and FEBA, with requirem
from MIDAS and unit movement data from TACWAR(Joint St

Other Promising Models

• ACAM (Air Courses of Action Model) - Used in PACOM and
model Korean scenarios (J8)[2]
•AWSIM (Air Warfare Simulation) - Air combat model used as
Joint Training Confederation; when used with JQUAD, Warrio
Center has found both useful for Air Tasking Order quality co

[2] **Conversation with Dr. Dean Hartley, 28 December 1998**

Survey of Available Tools

Other Promising Models (continued)

•CAPS (Commander's Analysis & Planning Simulation) - Tool f
defense against ballistic and cruise missiles in theater missile
• COAST (Course of Action Selection Tool) - Comparative anal
COA based on user-selected criteria applied to military / non-m
• GDAS (Global Deployment Analysis System) - Theater analys
deployment, transportation analysis, CONUS mobilization stat
tactical assembly areas, and deployment scheduling (Concepts
• Janus - Interactive, near real-time model developed to explo
between combat and tactical processes using land, sea, and ai
the battalion or brigade level (National Simulation Center)
• TAM (Theater Analysis Model) - Used to assess quantitative
issues, assessing COAs and resource planning, addressing con
with provisions for logistics and WMD effects (J8, PACOM, SO

Survey of Available Tools

Decision Support Tools in Development[3]

• BCAT (Base Capabilities Assessment Tool) and Unit Type Co
Development and Tailoring (UTC DT) - Provide input to COA d
and airfield beddown decisions
• DCAPES (Deliberate and Crisis Action Planning and Executi
Provides commanders and planners a level of information nec
planning, force tailoring, reporting, and tracking during all pl
• GCCS (Global Command and Control System) - Information
data management tools
• STEP (Survey Tool for Employment Planning) - Provide base
information for planning and execution

[3] **"Draft Assumptions for AEF / EAF Analyses", AF Agency for Studies and Analysis / SAAC, 7 Dec**

Survey of Available Tools

Decision Support Tools proposed by Industry[1]

- **(ACAAM) Air Courses of Action Assessment Model - GDE Syst**
- **(CASES) Campaign Analysis Simulation and Evaluation Syste**

BBN Technologies GTE Interworking, San Diego

- **C2 Decision Process Analysis Toolset - FTI, Washington DC**
- **CFAM - as a replacement for CTEM in JFACC Planning Tool**
- **Decision Support Toolbox - Chi Systems, San Diego**
- **Information Warfare Analysis Model - Innovative Managemen**

Sterling, Va

- **JFACC Decision Support Tool for Time-Critical Targeting - CA**

Center, Cal Poly Univ

- **JPT (JFACC Planning Tool) -**
- **Modeling of C2 Architecture and Performance Estimator - Sc**

Corporation, Chelmsford, Ma

- **Predictive Modeling and Campaign Simulation - Lockheed M**
- **SPAM (Sensor Platform Allocation Model) - in use by AFSAA**

[1] **Modeling and Simulation Symposium, ESC/DIS, Hanscom AFB, Massachusetts, 4 - 5 November next meeting is at AF Agency for M&S, Orlando, Florida, April, 1998**

Operational Needs

- Hypothesis: The Air Boss needs tools to
  - Provide distributed, integrated training of warfighters: C2, flight missions, support forces
    - Readiness for planned or pop-up / crisis tasking
  - ***Support Crisis Action Planning****
    - ***Course of Action and beddown / support analyses****
  - ***Rehearse operations through simulation****
    - ***Covert rehearsal of pop-up / crisis operations****
    - ***Analysis of operational branches and sequels****
    - ***Test-fly the Air Tasking Order (ATO)****
  - Maintain force readiness when deployed

areas in need of decision support improvements

Matrix of Decision Support Needs

Decision Support	Spectrum			Potential Sol
	OOTW	SSC	MTW	

- Fast data retrieval
  - Info sufficient for basing decisions
  - C2, ISR, M&S data sharing
    - Enemy order of battle
    - Friendly order of battle
- Force structure options
  - Locations of forces
  - Weapons proposed
  - Employment options
  - Support options
  - Course of action options
    - Recommendation to JFC
- Employment
  - ATO options
    - Allocation of forces
  - ATO fly-out
    - Logic
    - Survivability
    - Mission accomplishment
  - Next days' apportionment / effects